**Project Based Learning: Building a Fence** Paul Perkins

**Goals:**

* Students will work collaboratively in all aspects of the task.
* Students will use technology to plan and design a structure that complies with the task at hand.
* Students will use technology to collaborate and present their final product.

**Standards:**

* Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
* Solve real-world and mathematical problems involving the four operations with rational numbers. **(7.NS.3.)**
* Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."* **(7.EE.2.)**
* Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. **(7.G.4.)**
* Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. **(7.G.6.)**
* Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.* **(7.EE.3.)**
* Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
  + Solve word problems leading to equations of the form *px* + *q* = *r* and *p*(*x* + *q*) = *r*, where *p*, *q*, and *r* are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
  + b. Solve word problems leading to inequalities of the form *px* + *q* > *r* or *px* + *q* < *r*, where *p*, *q*, and *r* are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.* **(7.EE.4.)**

**Scenario:**

You work for a company called ‘Fancy Fences’ located in Kansas, Iowa. Billy Taft lives in a housing development called ‘Howard Homes’ near a wooded area. His wife, Helen, has quite a green thumb and a huge garden. Lately she has complained to her husband about the deer in the area eating up her tulips, beans, potatoes, sweet potatoes, tomatoes, and peppers. Helen spends a lot of time in her garden and wants a way to protect it. Billy has asked Fancy Fences to come up with a bid for her garden.

Helen wants an area of 20 x 30 feet fenced off for her garden. The requirements are that the fence deters deer, that there be a door wide enough to fit a wheelbarrow, it is sturdy, it will maximize sun exposure, and that the fence be cost efficient. Billy has asked Fancy Fences, Bob’s Barricades, Gabe’s Gates, and William ‘Wall’ Ace to provide bids and designs for the same project. Billy and Helen are in Europe completing their world tour of the smallest banks ever built. They intend on viewing your bid and presentation from across seas.

You will work in groups of 2 or 3 to design the fence and present the bid for the fence. You will need to save your project work in the class drop box. This will allow access by all members of your group at any time. You need to cite resources when applicable. There are three phases:

1. Pre-Construction: What will it look like? What do you need to do before you can start construction? Draw a picture before drawing it on the computer. Get ideas from the internet or look around your neighborhood for ideas.

* Provide a plan and a picture of what you intend on building. The free program Sketchup will be made available for the virtual construction of your project. Your picture must include dimensions when appropriate. Make it look professional, it is part of your presentation. You will need to provide at least 4 different perspectives of your final product. Don’t forget the door!
  + You may use alternative software to design your project, but it needs to be digital and stored in the drop box where your group members can access it freely.
* Provide a list of materials you think you might need. It can be generic or specific. The more you complete now, the less you have to complete later.
* Complete individual and partner(s) assessments
* **Submit your assignments and assessments in the wiki link for Phase 1**

1. Construction: What do you need to do to begin construction of the fence? What materials will you need? How much of the materials will you need? How much do they cost? Where will it be cheaper? Is cheaper better? How do you plan to minimize excess waste? Assume you have all of the appropriate tools you need for construction.

* When searching for your materials, use at least two different sources (stores) and compare your itemized list of materials displaying the totals at all of your sources. You will choose the source (store) that best fits your needs.
* You may use the Microsoft Excel provided with your laptops to develop the spread sheet for the materials. You may use alternative software to organize your material and/or costs. You must provide a list of materials and the cost of the materials for the spread sheet.
* Then on a separate document prepare the list of materials and the reasoning as to why you are using the materials you choose. (example: if you choose metal fencing over wood, I want to know why and your customer wants to know why) Your customer needs to know what they are buying, what it will be used for, and why you chose the materials. Use complete sentences.
* Complete individual and partner(s) assessments
* **Submit your assignments and assessments in the wiki link for Phase 2**

1. Presentation: Make your plan and bid presentable and clear for your client. It should be clear what the fence will look like and how much it will cost. Convince your client it will keep the deer away from the garden. Your presentation must be available to your clients in Europe. They will have internet available. You need to choose a digital forum for the storage and delivery of presentation materials. All writing must use complete sentences.

* Prepare at least three questions you think your will ask after viewing your presentation.
* Prepare responses for each of the questions anticipated in the previous bullet.
* In your presentation, provide your digital picture. Your picture should show at least 4 different perspectives.
* In your presentation, justify why you think your project will meet the requirements set forth by Helen.
* In your presentation, provide your client with a bid of the materials. Your bid should have the company name on it. It should be itemized by material, quantity, and cost.
* Your presentation will need to be presented without your assistance. Your client should be able to access your presentation and view it without your assistance. Some prior students have used Microsoft power point via google drive, flickr, animoto, youtube…….. feel free to any program you feel necessary, remember, your client has to view your presentation without your assistance.
* Complete individual and partner(s) assessments
* **Submit your assignments and assessments in the wiki link for Phase 3**

**When you are prepared to submit your presentation submit them on the class wiki.**

**Extensions:**

* Make your presentation so that you can customize the dimensions of the fence to the nearest 6 foot length.
* Provide accommodations for equipment in your fenced in area by including a small shed or storage bin.

Assessment

All three phases will have an individual and partner(s) assessment to be submitted.

Assessment: Complete the below sentence frames using where is the least productive and + is the most productive and justify why you/partner(s) earned your mark. Use complete sentences when appropriate.

1. I rate my performance as \_\_\_\_\_\_\_\_. I earned this because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. I rate my partner’s performance as\_\_\_\_\_\_\_. They earned this because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Phase 1 Assessment:

* The four digital drawings of their project and the list of materials: are they from 4 different perspectives with dimensions.
* The list: it can be generic, it just needs to be present.
* Individual and partner(s) assessment.

Phase 2 Assessment: Students will be assessed on their materials price comparison, price list they chose, and the reasoning for their decisions.

* The comparison needs to have at least two different materials lists with prices.
* The spread sheet needs to be itemized (quantities, cost, description) with company header.
* The justification needs to make sense given the solution at hand, answers may vary. Use complete sentences.
* Individual and partner(s) assessment.

Phase 3 Assessment: Students will be assessed on the anticipated questions and answers, requirements justification, presentation of the pictures and bid, and the method of presentation.

* The anticipated questions/responses have to relate to the task or the project. Complete sentences.
* Check to see there are at least 4 digital pictures of their fence from 4 different perspectives.
* Make sure the justification for the final product aligns with requirements and previous assessment.
* Check the final bid for consistency and company logo and total.
* Make sure the project is automated and online.
* Individual and partner(s) assessment.